LETTER OF TRANSMITTAL
W&W Engineering, LLC

130 West Summer Street, Suite 3
Greeneville, TN 37743
Phone: 423-638-2770 Fax: 423-638-8615

To:	Department of Environment & Conservation	Date: 9/2/16	Job #: 16-18
	Water Pollution Control	Attention : Mr. Mahendra Uphadyaya	
	William R. Snodgrass Tennessee Tower 312 Rosa L. Parks Avenue, 11th Floor	RE:	City of Church Hill, TN Sewer Line Extension on West Morgan Street
	Nashville, TN 37221		

We are sending you: X Attached ☐ Under separate cover via _____ the following items:

☐ Shop Drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of Letter ☐ Change order

Copies	Date	No.	Description
5			Plans & Technical Specifications
1			Design Report
1			Review fee Form and Check for $25

RECEIVED
SEP 07 2016
TN DEPT. OF ENVIRONMENT
AND CONSERVATION
DIVISION OF WATER RESOURCES

These are transmitted as checked below:

X For Approval ☐ Approved as Submitted ☐ Resubmit ___ copies for approval

X For Your Use ☐ Approved as Noted ☐ Submit ___ copies for distribution

☐ As Requested ☐ Returned for Corrections ☐ Return ___ corrected prints

☐ For Review and Comment

☐ For Bids Due _____ 20___ ☐ Prints Returned after Loan to Us

Copy to:	Signed: Cathy Walden Kyker, PE

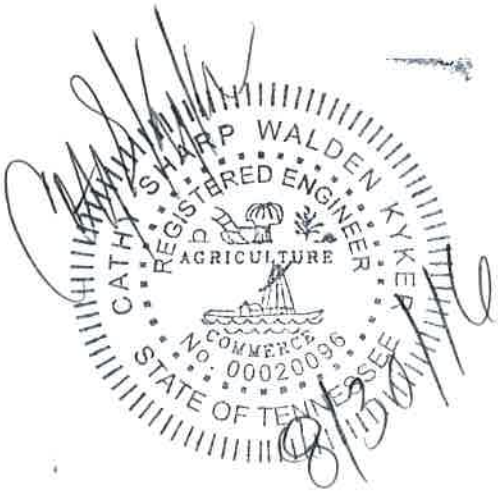
WPN16-0730

HYDRAULIC CALCULATIONS
FOR
SEWER LINE EXTENSION
WEST MORGAN STREET
CITY OF CHURCH HILL
HAWKINS COUNTY, TN

#16-18

WPN16-0730

AUGUST 2016



W & W ENGINEERING, LLC
800 WEST ANDREW JOHNSON HIGHWAY
SUITE 2
GREENEVILLE, TENNESSEE 37745
PHONE # 423-638-2770

The City of Church Hill has a gravity sewer line on West Morgan Street that serves several homes. There is one home at the end of the street and one vacant lot that cannot be served by the gravity line. The home currently has a septic tank installed but the system has failed and the homeowner now wants to connect to public sewer. A pump will need to be installed to service the home. This project includes the installation of a pressure sewer line to serve this home and the home to be constructed in the future on the vacant lot. There are already a few homes within the City that are serviced by individual pumps. This installation will follow the city's current policy. A pump (meeting the requirements of the City) will be purchased and installed at the homeowner's expense. It will be equal to the Hydromatic 2 HP grinder pump used in these calculations.

The high point of the force main from the pumps is at the manhole where the pressure line will connect. The flow from this line is estimated as follows:

$$2 \text{ homes} \times \frac{250 \text{ GPD}}{24 \text{ hr} \times 60 \text{ min}} \times 2.5 \text{ peaking factor} = 0.87 \text{ GPM}$$

This will be negligi

ble to the existing lines and will not adversely impact them. The individual grinder pumps' flow rate will be more than this and will vary depending on the number of pumps operating simultaneously, the system head for each pump, etc.

The calculations were done using attached Charts (to establish pipe flow and for velocity and head loss) published by Hydromatic Pump Company. The calculations were made from the farthest pump on the line (the vacant lot) since it will have to be able to pump all the way to the manhole. Flow rates, velocity, line size, line lengths, static heads, and number of pumps are listed below for this line.

Line Size	Length	Cumulative # of Pumps	Cumulative Flow in Section	Head Loss per 100 feet	Head Loss in section	Static Head	Velocity
2	224	2	25 gpm	1.01'/100'	2.26	15'	2.17 fps

Total Head = 2.26 + 15 = 17.26'

Total head loss for pump on vacant lot (lowest elevation and farthest distance) is 17.26. This is less than the capacity of the 2 hp grinder (which has a shut-off head of 105 feet).

Obviously, if the head went higher, the flow rate would reduce and the flow rate in pipe would be less reducing the head loss because of friction. This design is conservative. The existing lines and the proposed lines in the subdivision will be adequate.

Cathy Kyker, PE
W & W Engineering

TABLE VIII

SUGGESTED DESIGN FLOWS FOR 250 GPD AVERAGE DAILY FLOW

(3.5 People Per Dwelling)

(71.5 GPD Per Capita)

No. of Dwellings	Total Av. Flow (GPD)	GPM Av. Flow (GPM)	Peak to Av. Flow Ratio	Peak Flow (GPM)	Suggested Design Flow (GPM)
1	250	.174	4.46	.777	15
5	1,250	.870	4.39	3.82	30
10	2,500	1.73	4.35	7.53	
20	5,000	3.47	4.28	14.90	45
30	7,500	5.21	4.24	22.10	
40	10,000	6.94	4.20	29.15	
50	12,500	8.67	4.17	36.10	45
60	15,000	10.40	4.14	43.00	
70	17,500	12.13	4.11	50.00	
80	20,000	13.86	4.09	56.70	65
90	22,500	15.59	4.06	63.30	
100	25,000	17.35	4.04	70.20	75
110	27,500	19.08	4.02	76.70	
120	30,000	20.82	4.01	83.50	90
130	32,500	22.55	3.99	90.00	
140	35,000	24.28	3.98	96.60	100
150	37,500	26.01	3.96	103.10	
160	40,000	27.74	3.94	109.30	115
170	42,500	29.47	3.92	115.80	
180	45,000	31.20	3.91	122.00	125
190	47,500	32.94	3.90	128.50	
200	50,000	34.67	3.89	134.90	140
210	52,500	36.40	3.88	141.10	
220	55,000	38.13	3.87	147.50	
230	57,500	39.87	3.86	154.00	160
240	60,000	41.60	3.84	160.00	
250	62,500	43.33	3.83	166.00	
260	65,000	45.06	3.82	172.10	175
270	67,500	46.80	3.81	178.50	
280	70,000	48.54	3.81	185.40	
290	72,500	50.27	3.80	191.50	
300	75,000	52.00	3.79	197.00	200

The suggested design flows in the last column of Tables 5 through 11 represent a suggested interpolation at random intervals to facilitate line sizing and hydraulic calculations. In the lower range of accumulative homes (under 100) the influence of the storage-pumping action of the contributing units, when compared to the calculated peak flow, will determine the most acceptable lowest suggested design flow to use.

TABLE II
FLOW CHART FOR PVC SDR-21 PIPE
(Flow Coefficient C-150)

Flow GPM	1"		1¼"		1½"		2"		2½"		3"		4"		6"		8"	
Q	V	H_f	V	H_f	V	H_f	V	H_f	V	H_f	V	H_f	V	H_f	V	H_f	V	H_f
1	.297	.064																
2	.594	.219	.390	.079														
3	.888	.447	.586	.162	.430	.077												
4	1.19	.756	.781	.269	.573	.128												
5	1.48	1.11	.974	.402	.717	.187												
6	1.78	1.56	1.17	.557	.861	.261	.522	.079										
8	2.38	2.65	1.56	.929	1.15	.434	.696	.131										
10	2.97	3.98	1.96	1.39	1.44	.650	.870	.194	.609	.083								
15	4.46	8.48	2.93	2.93	2.16	1.36	1.30	.402	.919	.169								
20	5.94	14.54	3.90	5.00	2.87	2.31	1.74	.675	1.22	.285	.841	.121						
25	7.42	22.27	4.88	7.60	3.58	3.48	2.17	1.01	1.53	.421	1.05	.179						
30			5.86	10.61	4.30	4.89	2.61	1.41	1.83	.589	1.26	.248						
35			6.83	14.19	5.02	6.55	3.05	1.89	2.14	.786	1.47	.327	.855	.089				
40			7.82	18.40	5.73	8.35	3.48	2.43	2.44	.998	1.68	.417	.980	.113				
45			8.80	23.01	6.45	10.53	3.91	3.00	2.75	1.20	1.89	.519	1.09	.139				
50					7.17	12.87	4.35	3.65	3.05	1.61	2.10	.625	1.22	.164				
60					8.62	18.40	5.22	5.16	3.66	2.12	2.52	.881	1.46	.232				
70							6.10	6.91	4.27	2.86	2.95	1.17	1.70	.310				
80							6.96	8.97	4.88	3.66	3.36	1.49	1.96	.390				
90							7.83	11.15	5.49	4.55	3.79	1.87	2.20	.486				
100									6.10	5.56	4.21	2.27	2.44	.589	1.07	.078		
125									7.63	8.50	5.26	3.49	3.05	.901	1.35	.119		
150											6.31	4.85	3.66	1.26	1.62	.167		
175											7.37	6.48	4.27	1.68	1.88	.221		
200											8.42	8.39	4.89	2.13	2.15	.282		
225											9.47	10.53	5.50	2.67	2.42	.351	1.39	.093
250													6.11	3.16	2.69	.423	1.55	.111
275													6.72	3.88	2.95	.507	1.70	.132
300													7.33	4.57	3.23	.597	1.86	.156
325													7.94	5.35	3.50	693	2.01	.180
350													8.55	6.16	3.77	.797	2.17	.205
375															4.03	.902	2.32	.235
400															4.30	1.02	2.48	.263

CODE: V = Velocity in Ft./Sec.
H_f = Head Loss in Ft./100 ft. of pipe.

The values for Velocity and Friction Loss/100 feet used in this table are based on plastic pipe manufacturers and the Plastic Pipe Institute's suggested values and conversions for PVC Type SDR 26 pipe; PVC SDR-21 pipe, and PVC Schedule 40 pipe.

HYDROMATIC® HPGR200

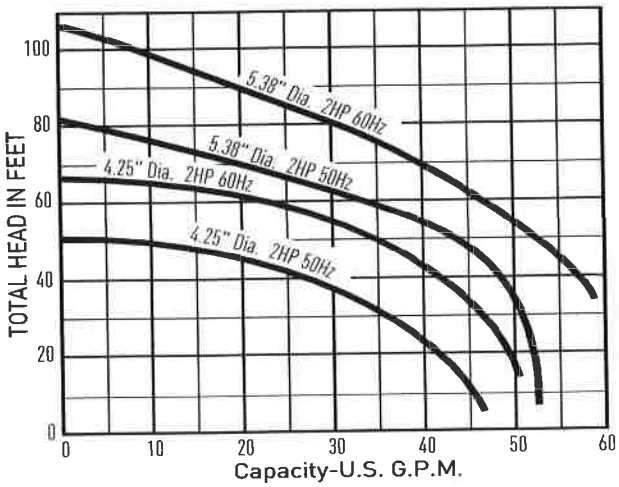
Pump Characteristics

Pump/Motor Unit	Submersible-Grinder
Hertz	60 Hz / 50 Hz
Phase	1 Ø
Voltage	230
Horsepower	2 HP
Full Load Amps	12.5/15
Motor Type	Oil Cooled Induction
	Capacitor Start
R.P.M.	2900/3450
Temp	140° F Ambient
Operation	Intermittent
Thermal Overload	Bi-Metallic
Temperature	Max Water 140° F
NEMA Design	Type A
Insulation	Class F
Discharge Size	1 1/4" NPT
Unit Weight	95 lbs.
Power Cord	Type SJOW/SJOW-A | Water Resistant | 600 V, 60° C | CSA/UL Approved | 20' Ft. Std.

Materials of Construction

Part Name	Material
Motor Housing	Cast Iron ASTM-48
Pump Casing	Cast Iron ASTM-48
Coolant/Lubricant	Dielectric Oil
Shaft	Stainless Steel
Mechanical	Seal Faces: Carbon/Ceramic Shaft Seal | Seal Body: Stainless Steel | Spring: Stainless Steel Bellows: Buna-N
Impeller	High Strength Valox 420SEO with Bronze Insert
Cutters	440C Hardened 55-60 Rockwell C
Upper Bearing	Single Ball Bearing
Lower Bearing	Single Ball Bearing
Fasteners	Stainless Steel

Performance Data



Dimensional Data

All dimensions in inches. Metric for international use.
Component dimensions may vary ± 1/8 inch.
Dimensional data not for construction purpose unless certified. Dimensions and weights are approximate. On/Off level adjustable. We reserve the right to make revisions to our product and their specifications without notice.

PENTAIR

USA
293 WRIGHT STREET, DELAVAN, WI 53115 WWW.HYDROMATIC.COM
PH: 888-957-8677 ORDERS FAX: 800-426-9446

CANADA
269 TRILLIUM DRIVE, KITCHENER, ONTARIO, CANADA N2G 4W5
PH: 519-896-2163 ORDERS FAX: 519-896-6337

Because we are continuously improving our products and services, Pentair reserves the right to change specifications without prior notice.

W-02-6710 (11/27/12)